

**11. Improve the water quality in Capitol Lake to meet State standards.** *[For additional information regarding this objective, refer to pages 8-1 to 8-10 in the Capitol Lake Adaptive Management Plan - 1999 to 2001 (1999).]*

**BACKGROUND**

The Deschutes River is a 57 mile long river that historically discharged into an estuary at the head of Budd Inlet. It resembled Mud Bay in Eld Inlet as it appears today -- shallow, deep sediments, nutrient rich water, and a mixture of salt and fresh waters. Its watershed is approximately 162 square miles and includes timber and agricultural lands and increasingly residential and urban land uses. Percival Creek, a four-mile long creek with approximately 13 square miles of watershed, also discharged to the former Budd Inlet estuary.

In 1951 a dam was built along the extension of Fifth Avenue blocking off the lower estuary to the free exchange of fresh and salt water during the ebb and flood cycles of the tides. The dam created a 320 acre fresh water impoundment from what had formerly been an estuarine environment. Although the newly created water body was named Capitol Lake, according to the lake definition in WAC 173-201A, it is actually an impoundment of the river. By definition, a lake must have a mean detention time of 15 days or longer. The mean detention time of water in Capitol lake can be less than one day depending on the winter flows in the river or up to 11 days during summer low flows.

Capitol Lake is now the largest fresh water source to southern Budd Inlet, and therefore has a significant effect on its water quality. In past years, GA undertook an annual summer lake drawdown for various reasons. This practice was discontinued after 1997 due to a number of water quality and fish habitat concerns. Water quality modeling simulations (completed in conjunction with the LOTT treatment plant upgrade) indicated that the summer drawdown had an adverse impact upon dissolved oxygen levels in Budd Inlet during late summer to early fall. The simulation (Brown and Caldwell, 2002) indicated that a measurable improvement of dissolved oxygen in lower Budd Inlet would result from the mixing of fresh and salt water afforded by an estuary.

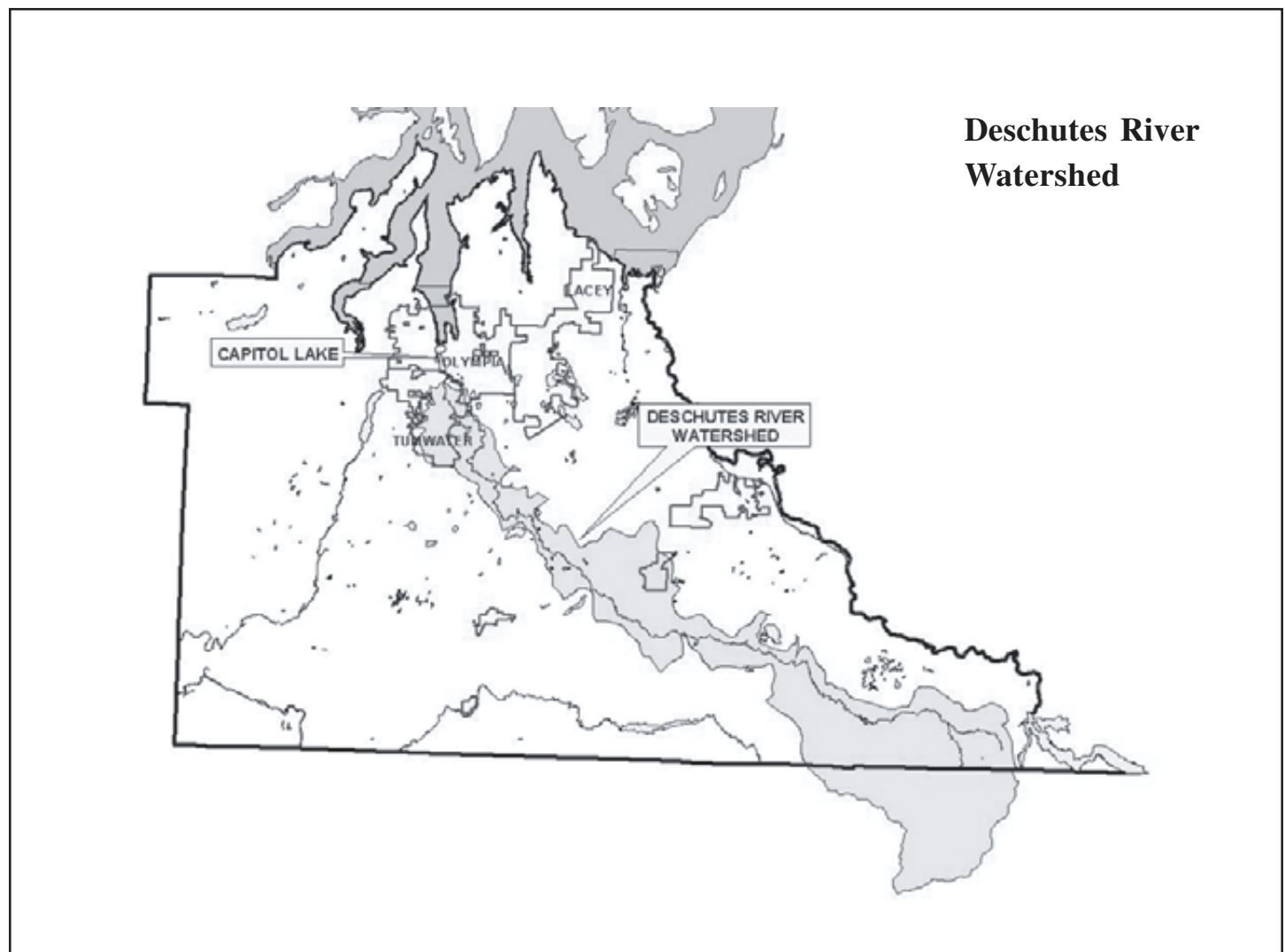
**Winter Flows**

There is a significant link between the water quality of the lake and Budd Inlet. The freshwater algae produced in Capitol Lake consume oxygen when it decomposes in the salt water environment north of the Capitol Lake dam. In lower Budd Inlet low dissolved oxygen levels occur in the summer months and are lowest near Capitol Lake (LOTT, 1998). Settling of this organic material also produces an increase in sediment oxygen demand in the inlet. Therefore, any development or lake management practice which increases the biomass of lake algae could further depress summer dissolved oxygen levels in Budd Inlet.

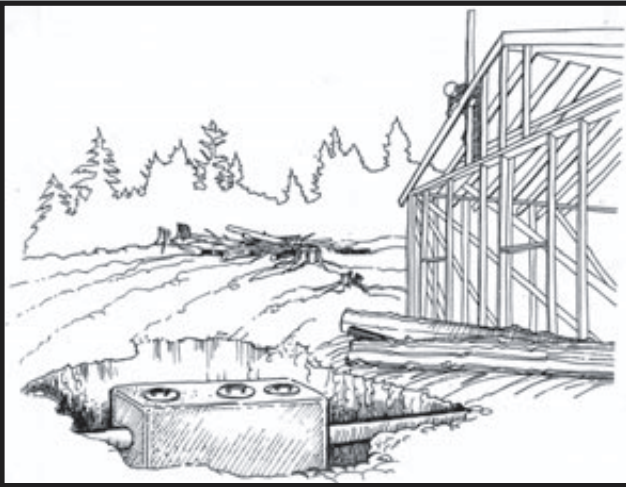
During the winter, flows in the Deschutes River are high and Capitol Lake is essentially an expansion of the Deschutes River. In 1993 a winter water quality study (Thurston County Environmental Health, 1993) found conditions between the north and middle basins of the lake to be very similar. Total suspended solids were found to decrease slightly between the two basins, implying that material was settling out of suspension as flow velocities decreased within the middle basin. Aside from sedimentation, winter water quality conditions have little influence on summertime conditions in the lake because the hydraulic detention time of the water is very short.

### **Summer Flows**

During the summer, flow in the river is low, detention time begins to approach that of a lake, and conditions common to eutrophic lakes appear. [In eutrophic lakes the production of filamentous and free floating algae and rooted aquatic plants increase, often to nuisance levels.] Past studies (CH2M Hill, June 1978 and WSU, 1975) concluded that plant growth in the lake is limited by both nitrogen and phosphorus at various times throughout the growing season. However, phosphorus is usually the nutrient in shortest supply, and the most manageable nutrient to control. Summertime inputs of nutrients have the greatest impact on algae production



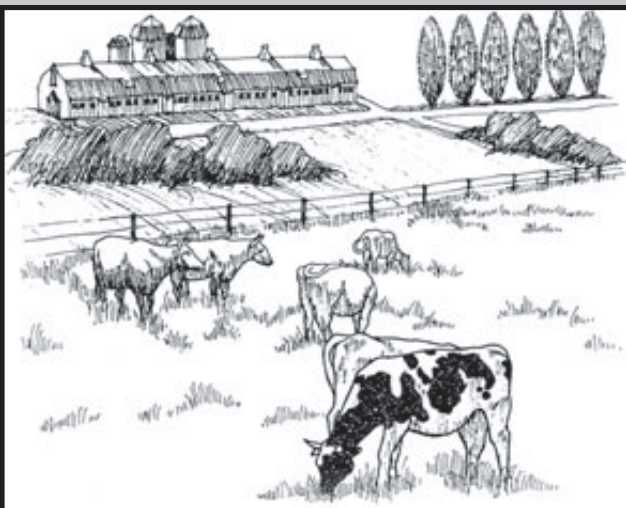
### Historic Sources of Nonpoint Pollution in the Deschutes Watershed



*Failing on-site systems.*



*Stormwater runoff.*



*Poor animal keeping practices.*

in Capitol Lake. Because almost all of the lake is less than 10 feet in depth, conditions are also ideal for rooted aquatic plants. However, the water column nutrient levels have less impact on rooted aquatic plant growth because they can utilize nutrients stored in the sediments.

A 1984 pollutant study (Entranco, 1984) estimated that 70% of the annual total phosphorus load to Capitol Lake was carried by the river, 8% was contributed by Percival Creek, 14% was attributable to the brewery discharges, and 8% miscellaneous sources. It was estimated that dairy discharges along the Deschutes River contributed 14% of the 70% carried by the river. Based upon these and other local water quality studies, sources of fecal coliform to the lake include failing on-site septic systems, stormwater outfalls, poor animal keeping practices, water fowl, and what's carried downstream by the Deschutes River and Percival Creek.

Limited water exchange and circulation in Capitol Lake in summer months also contributes to an increase in water temperature. Water quality standards for surface water temperatures were established to protect sensitive aquatic species, such as salmonids. Water temperature in the North Basin is often 3 to 5 degrees Celsius warmer than in the Deschutes River and typically near or above the Class A water quality standard (18 degrees Celsius maximum) during summer months.

Capitol Lake is on the Washington State Department of Ecology 303d list of impaired water bodies for violating state water quality standards for *Fecal Coliform Bacteria* and *Total Phosphorus*.

## **Water Contact Activities and Swimming**

In 1964 a bathing beach was constructed in the Northeast corner of the North Basin in what was called Capitol Lake Park. Swimming occurred there until 1985 when it was closed because of high fecal coliform counts, poor water visibility (caused by algae blooms), and poor water circulation. The old swimming area was filled in as a part of the construction of Heritage Park.

Since 1999 Thurston County Environmental Health has been collecting water samples in the middle and north basin. A set of five water samples were collected near the Heritage Park shoreline in June 2002. The sample results meet the state's lake water quality standards for fecal coliform bacteria (not more than 50 colonies per 100 milliliters and not more than 10% of the sample results exceeding 100 colonies per 100 milliliters). The water quality standards are established to protect the beneficial uses of lakes, including water contact recreation. Other water quality concerns along Heritage Park shoreline were also being reviewed in 2002, including lake sediment quality and potential contamination within the storm sewer systems that discharge to the lake.

A designated public bathing beach may serve hundreds of users at a time. The swimmers themselves are often a significant source of localized pollution. Because a natural body of water does not have continuous disinfection (as does a pool with water filters and chlorine), there are several factors to be considered when siting a bathing beach. Water quality and clarity, nearby and upstream source of pollution, water circulation into and out of the swim area, and safety features such as water depth, underwater obstacles, and aquatic plant growth are a few of the factors. The presence of silty lake sediments is a significant deterrent to establishing a successful swimming beach in Capitol Lake.

Poor water quality for swimming was first dealt with by periodically draining the lake and back flushing with salt water (from southern Budd Inlet). This practice was begun in 1968, and occurred up to several times during the summer. It was continued until the swimming beach was closed in 1985. Flushing the lake with salt water effectively destroyed the lake's fresh water ecosystem and a recent study shows that this practice depressed dissolved oxygen levels in southern Budd Inlet. Salt water back flushing of the lake was discontinued in 1997.

In 1982 a thick rubber swim curtain was installed around the swimming area, to separate it from the rest of the lake water. In 1983 sodium aluminate (alum) was used to improve water clarity inside the curtain, but a drawdown of the lake caused a rip in the barrier. Fresh water was added to the swim area from the city's domestic supply at a rate up to 1,000 gallons a minute which augmented two artesian sources that flowed into the swim area. Even with this high rate of dilution, bacterial counts within the swimming area did not meet swimming standards.

Operation and management of the former Capitol Lake swimming beach was the responsibility of the City of Olympia Parks, Recreation and Cultural Services Department. In 1987 Olympia commissioned a report to reestablish a swimming beach in Capitol Lake. The report concluded that the construction of a swimming pool was the only feasible solution to address these chronic water quality problems, and included several alternative pool designs.





*Swimming at Capitol Lake Park, c. 1964.*

Reestablishing a swimming area in Capitol Lake would require significant cost, and the commitment of a long-term management entity. Even then there would be no guarantee that the facility could meet bathing beach water quality and clarity standards. Such an area will require a suitable location with good circulation, an upland area with parking and restrooms, placement of sand on the lake bottom to reduce turbidity, no or manageable pollution sources (stormwater outfalls) in the immediate vicinity, and an adequate supply of clean water (which may include, but not be limited to, artesian wells or LOTT reuse water). The Department of General Administration would be willing to consider partnering with another public entity to manage a bathing beach in Capitol Lake, if these siting and water quality assurances can be met and reasonably maintained.

### **Current and Future Actions**

Since 1998 Thurston County has led a watershed planning process for the Deschutes River Water Resource Inventory Area (WRIA #13). There are 63 WRIA's statewide, and the boundaries are similar to a watershed. The process is focused on future water allocation and establishing in-stream flows which are based upon fisheries needs. Having adequate supplies of clean water is essential to fish and human uses within the basin. Another on-going watershed activity is the Thurston Conservation District's work on salmon recovery. In 1999 the Conservation Commission prepared a limiting factors analysis for the watershed. This report identified the most productive stream reaches for various species of salmon. It and other studies will help prioritize restoration efforts within the basin.

Beginning in 1999 General Administration contracted with Thurston County Environmental Health Department to collect summer water samples from the lake. This was necessary to collect current data and resolve inconsistencies between sampling sites and methods from previous water quality studies. The results from 2000 were encouraging. They showed a high level of dissolved oxygen, very low levels of fecal coliform and good water clarity. Results from 2001 sampling have been affected by the low flows of water from the Deschutes River. Sampling for 2002 was affected by the lake drawdown that occurred for the repair to Deschutes Parkway. Water quality results for 2002 are not available at this time.

The Washington State Department of Ecology will initiate a Total Maximum Daily Load (TMDL) project for the Deschutes River watershed during the 2003-2005 biennium. A TMDL plan will include Capitol Lake and Budd Inlet and any point discharge permits in the basin. The purpose of a TMDL plan is to identify the sources of pollutants and limit the nutrients coming into Capitol Lake.

#### **Activities in Years 2003 - 2005:**

GA will continue its contract with Thurston County Environmental Health to monitor water quality in the lake and work with Olympia, Tumwater, Thurston County and WSDOT to treat and reduce direct discharges into the lake from untreated stormwater. City of Olympia is focussing its efforts on reducing pollutants in stormwater discharges within the Capitol Lake Basin during this time period. The Washington Department of Fish and Wildlife, in cooperation with the Squaxin Island Tribe, is seeking to address nutrient loading in Percival Cove by siting another fish rearing facility with appropriate pollution controls somewhere in the basin. GA will also need to respond to unforeseen water related issues.

#### **CLAMP Budget 2003 - 2005:**

The cost to General Administration during this biennium will be \$45,000 to have water quality sampled by Thurston County Environmental Health. To provide for water quality contingencies will be \$45,000 for possible improvements.

#### **Activities in Years 2005 - 2013:**

Implementation of the TMDL study would occur during this time period. GA would continue to monitor lake conditions and respond to water quality issues and make improvements.

#### **CLAMP Budget 2005 - 2013:**

The cost to General Administration to continue with ambient lake monitoring and to make water quality improvements is estimated at \$740,000.